Budd Inlet Dissolved Oxygen TMDL

Updated project plan: May 3rd, 2017

Contents

1. Project Scope

The TMDL will explain the roles, authorities, and actions needed of cleanup partners to address water quality issues related to Dissolved Oxygen in Budd Inlet. These partners include local governments, tribes, agencies, permittees, and the community. The TMDL prioritizes specific actions to control and reduce pollution sources needed to improve water quality and achieve Washington State water quality standards (WQS).

The report, referred to as the *Budd Inlet Dissolved Oxygen TMDL*, will establish numeric load allocations (LA) and wasteload allocations (WLA) needed to reduce human impacts on DO to meet WQS. The WLAs will get incorporated into the appropriate permits upon their renewal. The TMDL will consider impacts from the Deschutes River as reported in the Deschutes River, Percival Creek, and Budd Inlet Tributaries Multi-Parameter TMDL completed in 2015. **Due to the complexity of the issues related to Budd Inlet and Capitol Lake, we phased the work by separating the freshwater and marine water TMDLs. This TMDL will focus only on the marine waters of Budd Inlet.**

Waterbody	Parameter	Listing ID
Budd Inlet	Dissolved Oxygen	3769, 3770, 5852, 5853, 5862, 5863, 5864, 7582, 7583, 7584, 7585, 7586, 7587, and 10188

Table 1. Listings included in TMDL.

Exclusions: This TMDL is not addressing the following listings.

Waterbody	Parameter	Listing ID
Budd Inlet	Bacteria	45317, 45829, 61005
Capitol Lake	Bacteria	40588
Capitol Lake	Total Phosphorus	22718

Table 2. Listings excluded from TMDL.

2. Water Quality Standards

Designated uses associated with Budd Inlet are shown below in Table 3. Note that Budd Inlet is divided into two sections – the dividing line being latitude 47°04, or roughly Priest Point Park. Designated uses for both portions of Budd Inlet can be found in Section WAC 173-201A-612 of the Water Quality Standards for Surface Waters of the State of Washington and are summarized below.

Use Designation		Budd Inlet (South of Priest Point Park)	Budd Inlet (North of Priest Point Park)
Aquatic life uses	Extraordinary		
	Excellent		**X**
	Good	**X**	
	Fair		
	Shellfish Harvest		**X**
Recreational uses	Primary Contact	**X**	**X**
	Secondary Contact		
Miscellaneous uses	Wildlife habitat	**X**	**X**
	Harvesting	**X**	**X**
	Commerce and navigation	**X**	**X**
	Boating	**X**	**X**
	Aesthetics	**X**	**X**

Table 3. Use designations for Budd Inlet.

The aquatic life criteria for dissolved oxygen in marine waters can be found in Section WAC 173-201A-210. Relevant summary details are provided below in Table 4.

Category	Lowest 1-Day Minimum
Extraordinary Quality	7.0 mg/L
Excellent Quality	6.0 mg/L
Good Quality	5.0 mg/L
Fair Quality	4.0 mg/L
When a water body's DO is lower than the criteria above (or within 0.2 mg/L of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L.	

Table 4. Aquatic life dissolved oxygen criteria in marine waters.

Ecology's modeling results show that Budd Inlet meets the 6.0 and 5.0 mg/L water quality standards under natural conditions, but not under existing conditions. As shown in *Figure 1*, East Bay has the lowest dissolved oxygen under natural conditions and the largest violation under existing conditions.

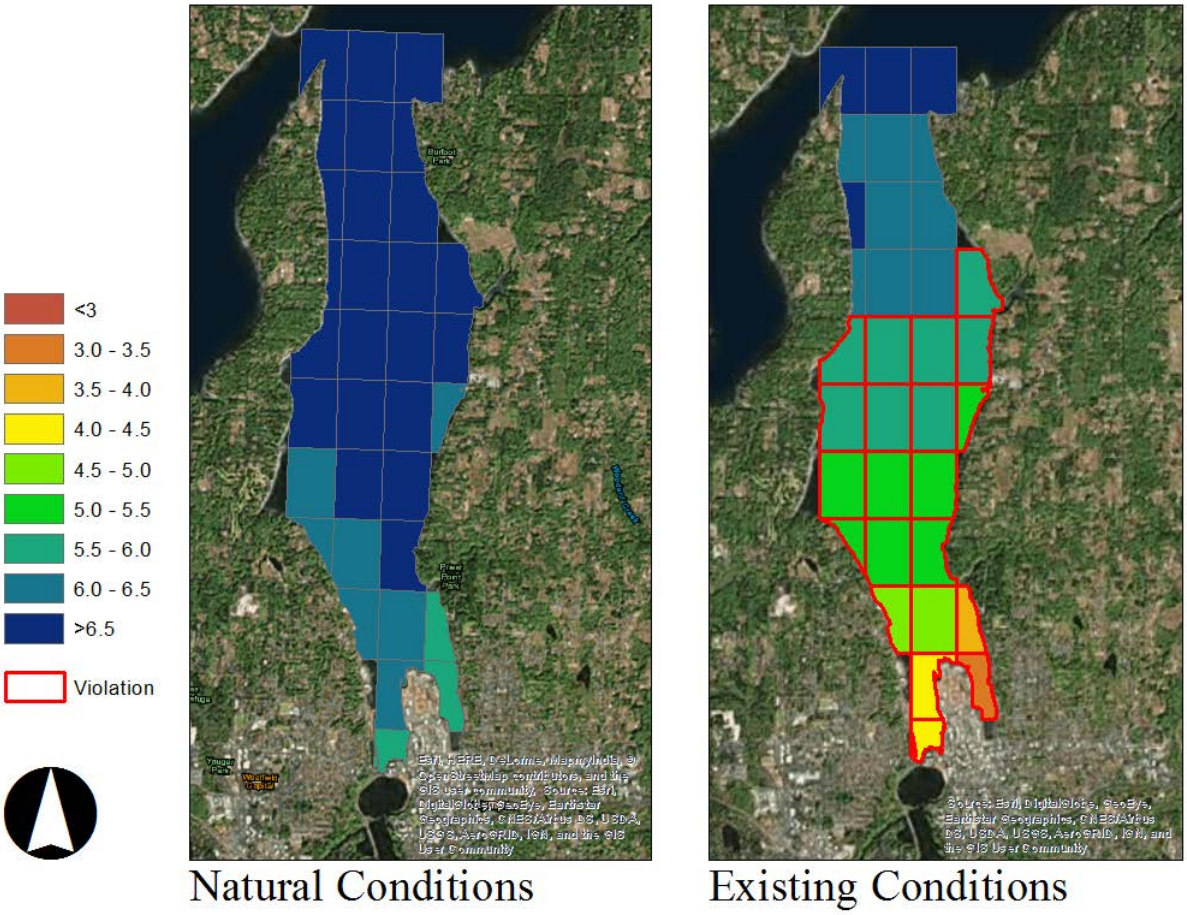

Figure 1. Modeling of dissolved oxygen in mg/L on the day with lowest DO.
** Produced with data from 4/28/17 model runs.*

3. Relevant Background

Budd Inlet

Budd Inlet is impacted by wastewater treatment plants (WWTPs) that discharge directly into Budd Inlet, nonpoint sources (NPS) coming directly into Budd Inlet, external WWTPs and NPS (coming from the northern open boundary with the greater Puget Sound), and the Capitol Lake Dam itself. (For more information on external sources please see Section Five, Potential Policy Issues and Significant Challenges.)

Ecology's model show that the Capitol Lake Dam has the largest impact on DO depletion throughout Budd Inlet. Figure 2 shows the individual impact of each of the four above mentioned groups on each of the model grid cells.

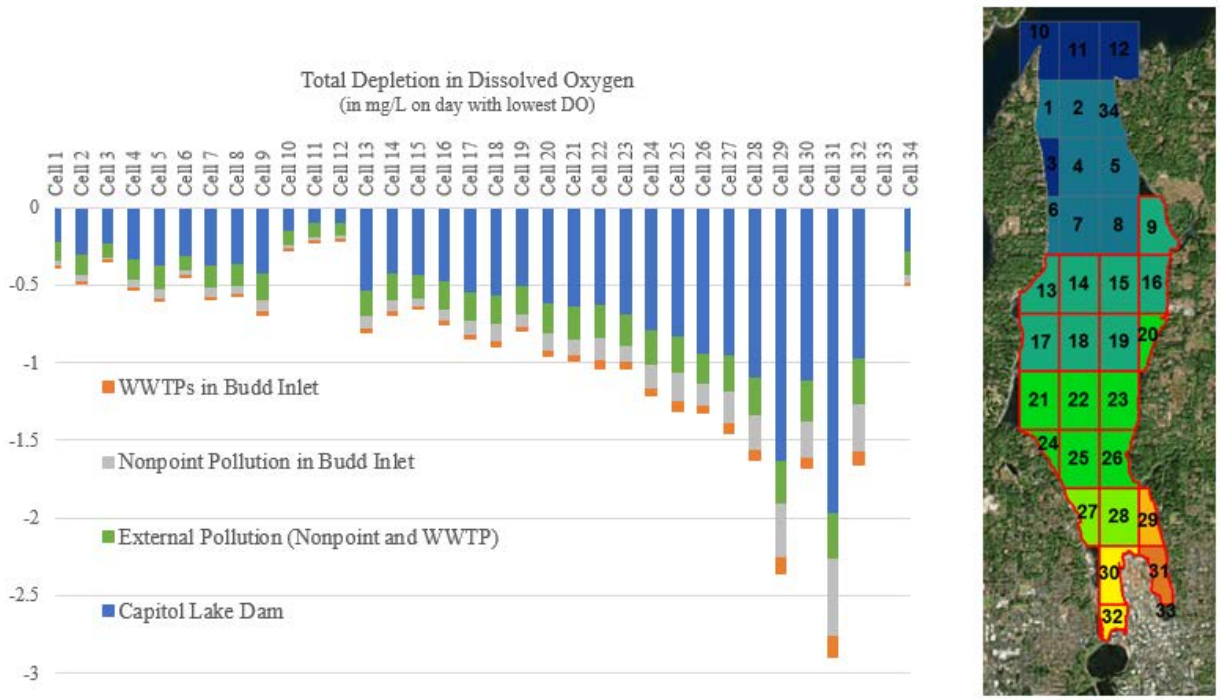

Figure 2. Dissolved oxygen depletion in Budd Inlet from different sources.
** Produced with data from 4/28/17 model runs.*

The depletion of DO caused by the dam is due to a combination of factors, including:

- *The dam creates a pulsed flow that alters circulation in Southern Budd Inlet.*
- *The dam and lake alter the concentrations and loads of carbon.*
- *The dam and lake alter the concentrations and loads of nitrogen. The assimilation of inorganic nitrogen by freshwater plants (e.g. phytoplankton) with corresponding production of organic carbon alters discharges into Budd Inlet.*

Capitol Lake is more efficient at producing organic carbon than a natural estuary. The greater production of organic carbon within the lake compared with a natural estuary leads to a greater depletion of DO in Budd Inlet. Decomposition of the excess organic matter is the primary mechanism of DO depletion. See Figure 3 for a diagram of these processes.

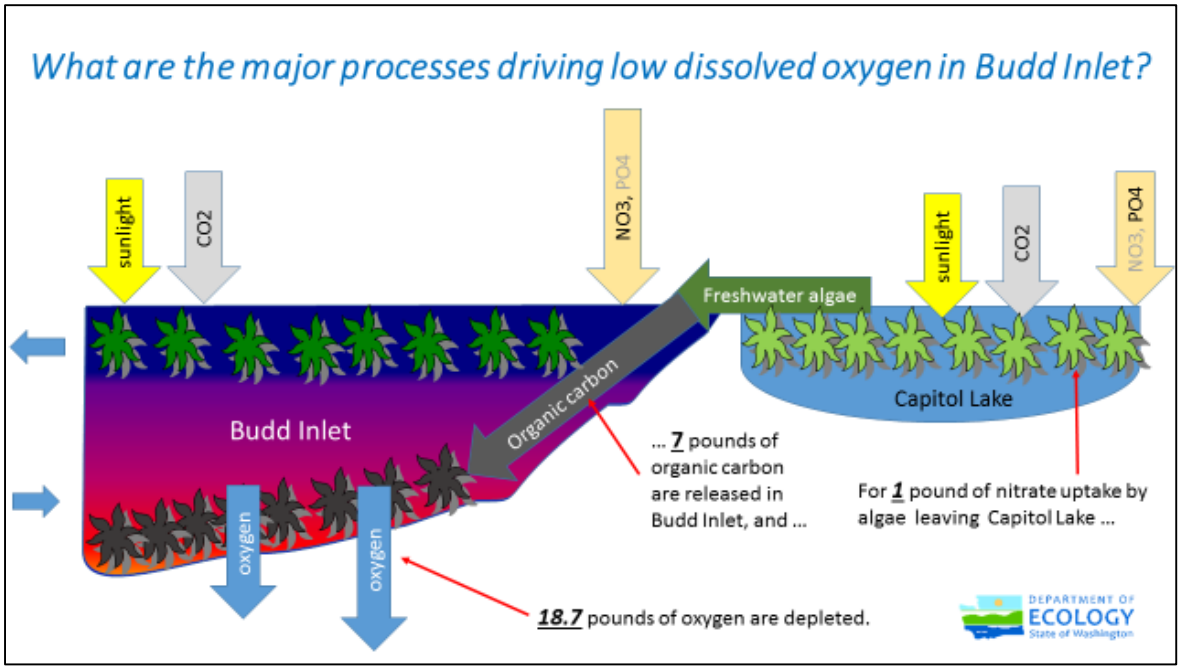

Figure 3 . Diagram of major processes affecting dissolved oxygen in Budd Inlet.

Capitol Lake

This TMDL is not addressing 303(d) listings in Capitol Lake. However, Capitol Lake does affect the water quality in Budd Inlet.

The WQS for Capitol Lake is that human actions considered cumulatively may not decrease the DO concentration more than 0.2 mg/L below natural conditions. Strong stormwater and other nonpoint source reductions could reduce the phosphorus loads that affect DO. Even if all human phosphorus sources were controlled, natural phosphorus concentrations from the large Deschutes River and local watersheds would deliver ample nutrients to support excessive suspended plant growth in the shallow waters of Capitol Lake. Watershed controls are still important to support healthy functions in the riverine environments. These controls should happen even though they would not benefit Capitol Lake itself.

If Capitol Lake became an estuary, the WQS standard would be the same as the standard for southern Budd Inlet, which is Good Quality (5.0 mg/L). If naturally concentrations fall below 5.0 mg/L, then the standard is also that the combined effects of all human activities must not cause more than a 0.2 mg/L decrease below that naturally lower oxygen condition.

4. Model Background and Current Status

Ecology's model for Budd Inlet is based off of the 1998 Budd Inlet Scientific Study (BISS) completed by LOTT. Ecology added Capitol Lake into the model as an additional boundary condition, using data from 1997 to match the original BISS inputs. The model was then calibrated and verified using data from 2004 and 2001. The model also went through three phases of peer review, including an external review and two independent EPA sponsored reviews.

Since the Supplemental Modeling Scenarios came out in 2015

- *Sediment Fluxes: The new version of the Budd Inlet input model adds in sediment flux scalers from the Salish Sea model.*

Sediment diagenesis has been incorporated into the Salish Sea model but not the Budd Inlet model. This means that each time a scenario is modeled, both models must be run, increasing the processing time.

The current model includes inputs from four WWTPs, the Deschutes River, and nine creeks and runs from Jan 25th to September 15th. See Figure 4 below.

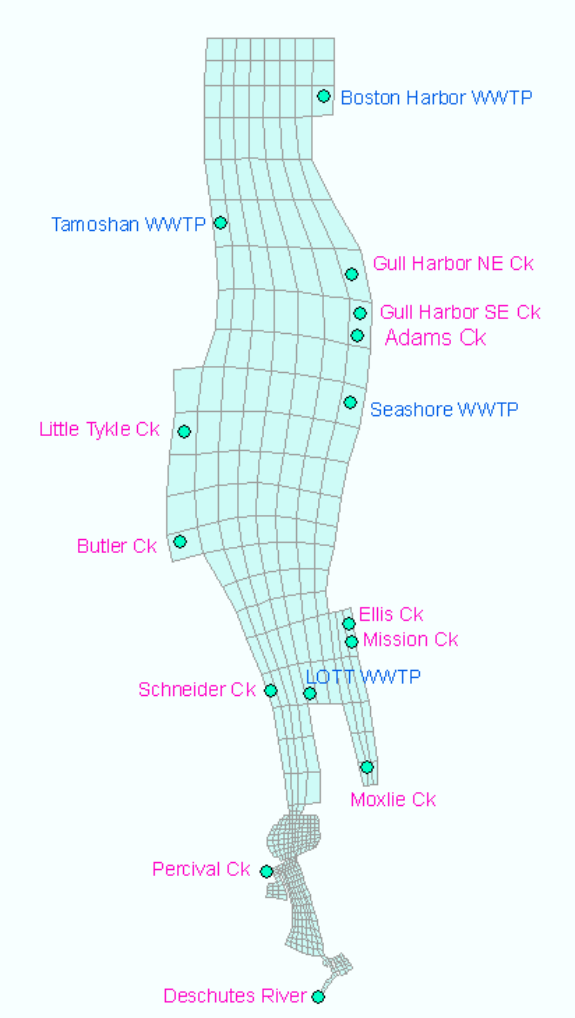

Figure 4. Permitted and non-permitted sources included in the model (as of January 2017).

There are additional individual and general permittees that have not been incorporated into the model. A decision will need to be made regarding whether these sources need to be added into the model or whether an alternative method can be used to determine their allocations. All known permittees with discharges into Capitol Lake and Budd Inlet are listed below in Table 5.

Category	Permittee Name	Permit Number	Permit Manager	Office	Model Status
Muni NPDES IP	Boston Harbor STP	WA0040291	Vicky Epp	WQ/SWRO	**YES**
	LOTT Budd Inlet Water Reclamation Facility	WA0037061	Dave Dougherty	WQ/SWRO	**YES**
	Seashore Villa STP	WA0037273	Dave Dougherty	WQ/SWRO	**YES**
	Tamoshan STP	WA0037290	Vicky Epp	WQ/SWRO	**YES**
No permit	Department of Enterprise Services	N/A	N/A	N/A	**YES**
Industrial NPDES IP	Port of Olympia (Budd Inlet)	WA0040533	Mohsen Kourehdar	TCP/SWRO	NO
	(Port of Olympia) East Bay Development	WA0040231	Mohsen Kourehdar	TCP/SWRO	NO
MSWGP (Phase II)	Department of Enterprise Services	WAR045210	Rian Sallee	WQ/VFO	NO
	City of Olympia	WAR045015	Rian Sallee	WQ/VFO	NO
	Port of Olympia	WAR045206	Rian Sallee	WQ/VFO	NO
	Thurston County	WAR045025	Rian Sallee	WQ/VFO	NO
Industrial SW GP	Bay Marine Leased Yard	WAR304006	Paul Stasch	WQ/SWRO	NO
	Pacific NW Bulkhead Yard	WAR304545	Paul Stasch	WQ/SWRO	NO
	Dunlap Tow Olympia Log Yard	WAR000106	Paul Stasch	WQ/SWRO	NO
	Port of Olympia (Ocean Terminal)	WAR001168	Paul Stasch	WQ/SWRO	NO
WA DOT MSWGP	WA DOT	WAR043000	Foroozan Labib	WQ/HQ	NO
Boatyard GP	Swanton Boatworks	WAG031043	Paul Stasch	WQ/SWRO	NO
Upland Fish Hatchery IP	WDFW (Pioneer Park)*	WAG137020	Paul Stasch	WQ/SWRO	NO
Upland Fish Hatchery IP	WDFW (Tumwater Falls)**	N/A	N/A	N/A	NO
Construction SW GP	Various	Various	Sam Knox	WN/AQ/SWRO	NO

Table 5. Relevant individual and general permittees.

***** *Facility is in development and has not yet applied for NPDES permitting.*

****** *Facility currently does not require NPDES permit but anticipated future upgrades may change this requirement.*

5. Potential Policy Issues and Significant Challenges

A number of potential policy issues and challenges have already emerged. Ecology is having bi-weekly calls with EPA staff to try and work through solutions to each of these items. Description of current issues are provided below. A spreadsheet tracking each of these issues is kept here, on the SharePoint site. Updates will be made as decisions are made and new issues arise.

External Sources and Bubble Allocation
The Budd Inlet TMDL will need to include allocations for external sources that enter the inlet via the northern boundary with Puget Sound. This could mean needing to create individual WLAs for all permitted sources in the greater Seattle area and LAs for all nonpoint sources based on their impact on Budd Inlet. This would drastically lengthen the time frame of the Budd Inlet TMDL process and require us to engage with a large set of stakeholders from other regions.

A concurrent TMDL (or TMDL alternative) for the Puget Sound is also under development and will likely take place over a much longer time frame. This means all allocations would need to be adjusted again during that process.

The following options are currently being considered, with a strong preference for option 1b.

1. *Develop separate Budd Inlet and Puget Sound DO TMDLs.*
    a. *Budd Inlet sets interim WLAs and watershed inflow targets for external sources; Puget Sound TMDL revises WLAs.*
    b. ***A phased TMDL. Budd Inlet TMDL sets loading capacity for the sum of external (to Budd Inlet) sources; Puget Sound TMDL figures out how to allocate the bubble to external sources.***
2. *Combine Budd Inlet TMDL into Puget Sound DO TMDL.*

More background information can be found here.

Conversations with EPA have indicated that this would be an approvable approach ***providing that the Puget Sound work is indeed pursued as an official TMDL or within an alternative framework that gives assurances equivalent to a TMDL.***

As of February 8th, 2017 we've received approval to move forward with this approach from Heather Bartlett, WQP Program Manager.

Aesthetics
EPA has expressed concern that the Budd Inlet TMDL does not address aesthetic use. Recently, Spokane Riverkeeper filed a lawsuit regarding a TMDL for Hangman Creek claiming that EPA approved the TMDL even though it did not address aesthetic values. EPA has also brought to our attention a similar lawsuit regarding a TMDL for the Anacostia River in Virginia. We will need to derive a method to show how our TMDL is protective of these additional uses.

Reasonable assurance
Under the Clean Water Act, when setting allocations for mixed TMDLs (TMDLs that include reductions for both nonpoint sources and point sources), Ecology must provide reasonable assurance that nonpoint source reductions will occur in order to provide any allocation to point sources. An excellent summary of the issue with documentation of specific EPA guidance documents can be found here (Environmental Law Institute, 2011).

The lake is not a permitted source and therefore is considered a nonpoint source. It may be challenging to provide reasonable assurance considering the political, financial, and public relations issues surrounding the Capitol Lake versus Deschutes Estuary debate. Additionally, Ecology cannot force the Department of Enterprise Services (DES, who manages the lake) to follow any particular course of action, like removing the dam.

Recent conversations with EPA have indicated they understand that there is not a "high" likelihood of solving the Capitol Lake problem (although there is a good opportunity) and there is no way to meet water quality standards without addressing Capitol Lake. EPA has indicated that this alone would not prevent the TMDL from being approved.

As of March 2017, Ecology is considering writing two sets of allocations – one in the case that the dam and Capitol Lake are (or will be) removed and one in the case that they have not been removed within a certain time period.

6. Modeling Phases

We have established four modeling phases to be completed in 2017. Each phase will include between two and six model runs and is anticipated to take EAP one to two months to complete. The first phase is described in detail below. The remaining phases are generally planned out with more details forthcoming.

Modeling Phase 1 (Time frame: February - April)
This first set of model runs will explore the impact of LOTT and Capitol Lake on Budd Inlet. We'll consider both LOTT and Capitol Lake in isolation of each other and against natural conditions.

Scenario 1A – Impact of LOTT.
This run will separate out the impacts from LOTT and the other wastewater treatment plants in the model (Tamoshan, Boston Harbor, and Seashore Villa).

- Start with natural conditions.
- Add in LOTT, for all months.
- Do not add in other WWTPs.

Scenario 1B – Impact of LOTT winter loading on spring/summer loads.
LOTT does not have effluent limits in the winter and discharges higher quantities of Total Nitrogen in these months. The goal of this run will be to explore whether winter loads are dispersed across the open boundary with the greater Puget Sound or if they remain in Budd Inlet contributing to water quality violations in warmer months. Nitrogen that remains in Budd Inlet may exist within the water column itself or may accumulate in sediment and re-release into the water column over time.

- Start with natural conditions.
- Add in LOTT, for January, February, and March. (LOTT remains OFF April – October).
- Do not add in other WWTPs.

Scenario 1C – Benefit of turning LOTT off in August and September.
In a previous model scenario (Scenario 2) discharges from LOTT were turned off completely for the summer months of June through September. This would require LOTT to reclaim 100% of their wastewater during these four months. Such extensive reclamation is not feasible. However,

the best time for LOTT's Reclaimed Water Plant to reclaim their discharge is August and September.

- Start with natural conditions.
- Add in LOTT for January through July. (LOTT remains OFF August and September.)
- Do not add in other WWTPs.

Modeling Phase 2 (Time frame: June - August)
To this point, model runs have primarily been exploratory in nature. Phase three will use information from previous runs to set potential allocations with the goal of narrowing down options for the TMDL. Maximum of eight scenarios.

Modeling Phase 3: (Time frame: October – December)
This phase will serve as a time to run a limited number of scenarios in order to determine the final draft allocation scheme for the TMDL. Maximum of eight scenarios, which may be broken up into smaller batches over the three month time period.

Additional notes on modeling:
This plan does not included modeling any scenarios that would require new modifications to input files or the structure of the model. If DES requested us to model some sort of hybrid scenario, this would require additional development and scoping. We do not anticipate this but will need to consider this type of request if made.

7. Collaboration with EAP

EAP will assist water quality in completing the TMDL by leading all modeling efforts and completing various technical components of the water quality improvement plan.

Modeling Needs (2017)
EAP will be responsible for completing modeling as described above. After each phase of modeling EAP with supply the WQ team with DO output files from the model and maps of DO concentrations in Budd Inlet. Between model phases there may be some additional collaboration between EAP and the water quality team to determine specifics for the next round of model scenarios.

At some point, DES may request that we model hybrid lake/estuary scenarios. Creating these scenarios may require additional modifications to the model by EAP.

Providing Data
In addition to providing data model output data at the end of each model phase, additional data sets or products may be requested by the WQP. Water Quality will work with EAP to prioritize these requests and will attempt to have WQP staff do as much of the analytical work as possible.

Loading Capacity (late 2017, early 2018)
Determining the loading capacity of Budd Inlet ($\sum$ WLAs + $\sum$ LAs + Margin of Safety = Loading Capacity = meeting WQS) is a requirement of the TMDL. EAP will lead the effort to determine the loading capacity.

Allocations (late 2017)
The water quality team will lead the effort to determine WLAs and LAs for all sources but may call on the expertise of the EAP team for advice and assistance.

Technical Writing (2018)
The following sections of the water quality improvement plan will need to be completed by EAP:

- Analytical approach (including study methods and modeling framework)
- Study results
- Loading capacity

EAP will likely be called on to assist or advise the completion of additional sections of the final TMDL.

Other Anticipated Needs
Requests from the public regarding the model and/or science behind the Budd Inlet TMDL may be directed to EAP as necessary.

8. Communications Strategy

A more detailed communications strategy will be developed as the TMDL develops. The strategy will include the following elements:

Deschutes Advisory Committee (DAG)
Beginning in 2017 the DAG will be facilitated by Thurston County and the Thurston Conservation District. Ecology will still be an active participant and use the DAG as a venue to distribute pertinent TMDL related information. We anticipate attending all meetings and providing formal presentations as necessary and appropriate.

Meetings with Stakeholders
One on one meetings with stakeholders will occur in early 2017 to gauge interest, concerns, and perspectives. Group meetings and/or presentations will occur as needed or requested throughout 2017. Additional outreach needs will be gauged for 2018 and beyond as appropriate.

Meetings with Permittees
Permitted stakeholders (listed in Table 5) will be consulted throughout the TMDL process to discuss and draft potential wasteload allocations. While this may occur at any point during the process, we anticipate a concentrated effort between model phases two and three.

Public Comment
A public comment period will occur after an internal review of the draft TMDL plan has occurred. Ecology with develop a plan to gather community feedback and respond to comments.

9. Project Schedule (*see detailed schedule for 2017 here.*)

Project Component	Timeline
Deschutes Advisory Group Meetings	Continuously and as needed.
Modeling Phase 1 Phase 2 Phase 3	 February - April (2017) June - August (2017) October - December (2017)
Meetings with Permittees	As needed. Expected concentrated effort May/June and September/October(2017)
Meetings with Stakeholders	One on ones in early 2017. As needed moving forward.
Determine solutions to policy issues and significant challenges	2017-2018
Report Writing	2018
Public Comment	2019

10. Publications and existing data sources.

1	Budd Inlet TMDL website	http://www.ecy.wa.gov/programs/wq/tmdl/deschutes/Phase2.html
2	Deschutes Advisory Group website	http://www.ecy.wa.gov/programs/wq/tmdl/deschutes/advgrp.html
3	Deschutes River Watershed main website	http://www.ecy.wa.gov/programs/wq/tmdl/deschutes/index.html
4	Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings (Ecology Publication)	https://fortress.wa.gov/ecy/publications/summarypages/1203008.html
5	Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Improvement Report and Implementation Plan (Ecology Publication)	https://fortress.wa.gov/ecy/publications/summarypages/1510012.html
6	Deschutes River, Capitol Lake, and Budd Inlet Total Maximum Daily Load Study: Supplemental Modeling Scenarios (Ecology publication)	https://fortress.wa.gov/ecy/publications/SummaryPages/1503002.html
7	Frequently Asked Questions website	http://www.ecy.wa.gov/programs/wq/tmdl/deschutes/qa.html
8	Permitting and Reporting Information System (PARIS) Database *(to identify water quality permits in any watershed)*	http://ecydblcywqdp1/wq/f?p=106:1:1957357814001090

11. Team Members

Name	Program	Expertise
Ahmed, Anise	EAP	TMDL Technical Project, modeling, project knowledge, writing technical analysis
Kolosseus, Andrew	WQ/SWRO	Unit Supervisor
Weiss, Leanne	WQ/SWRO	TMDL Project lead, meeting coordination and facilitation, presentation development, identifying implementation actions, coordination with internal and external stakeholders, TMDL process coordination, report writing

Additional Resources

Name	Office	Expertise
Bartlett, Heather	WQ/HQ	Program level management decisions
Bennett, Dave	SWRO	Communications and media outreach
Bresler, Helen	WQ/HQ	Policy related issues
Dent, Diane	WQ/HQ	Publications, website postings, and EPA submittal preparation
Doenges, Rich	WQ/SWRO	Section level management decisions
Dougherty, Dave	WQ/SWRO	Wastewater Treatment Plant permits
Figueroa-Kaminsky, Cristiana	EAP	Unit level management decisions related to modeling work
Fleskes, Robin	WQ/SWRO	Formatting, reviewing, and editing draft report; ensure consistency with program and agency standards
Fricke, Laura	WQ/NWRO	Unit level management (NWRO WWTPs)
Knox, Sam	WQ/SWRO	Construction Stormwater General Permit
Kolosseus, Andrew	WQ/SWRO	Unit level management decisions
Kourehdar, Mohsen	TCP/SWRO	Individual permit
Pelletier, Greg	EAP	TMDL Technical Project, modeling, project knowledge
Rau, Ben	WQ/HQ	Nonpoint sources best management practices
Sallee, Rian	WQ/SWRO	Municipal Stormwater Permit
Stasch, Paul	WQ/SWRO	Industrial Stormwater and Aquaculture General Permits
Toteff, Sally	SWRO	Regional level management coordination, input, and liaison
Bilhimer, Dustin	WQ/HQ	South Puget Sound
Zentner, Greg	WQ/SWRO	Unit level management (SWRO WWTPs)